**PERSONALIZED RULE-BASED CLOSED-LOOP CONTROL ALGORITHM FOR TYPE 1 DIABETES**

A. Rodríguez-Herrero[1,2], G. García-Sáez[1,2], F. García-García[1,2], C. Pérez-Gandía[2,1], M. Rigla[3], M.E. Hernando[1,2]

*[1]Bioengineering and Telemedicine Group, Technical University of Madrid, Spain, [2]Biomedical Research Networking Centre in Bioengineering, Biomaterials and Nanomedicine (CIBER-BBN), Madrid, Spain, [3]Endocrinology and Nutrition Dept. CSPT Hospital de Sabadell, Sabadell, Spain*

Definitivo:

BACKGROUND

Type 1 diabetes mellitus implies a life-threatening absolute insulin deficiency. Artificial pancreas (CGM sensor, insulin pump and control algorithm) is promising to outperform current open-loop therapies.

METHODS

We designed a predictive rule-based algorithm (pRBA) that uses current and past CGM glucose measurements, a predicted rate-of-change (pROC) for glucose and patient's optimal basal therapy (OBT). It requests information about pre-prandial boluses administered manually in accordance to the amount of carbohydrate intake. Prior to its use, pRBA demands patient-based individual adjustment.

Controller's performance was tested "in-silico" using the Virginia/Padova simulator in two scenarios of suboptimal basal insulin regimes (±20% deviation with respect to OBT). We measured time spent on target BG range (70-180 mg/dl) during pRBA control and compared it against CSII therapy for the period between 10:00pm and 2:00pm of the next day. We distinguished two stages: night/basal (10:00pm-08:00am) and breakfast/post-prandial (08:00am-02:00pm).

RESULTS

The pRBA provided a superior metabolic control for the 120%-OBT scenario by decreasing hypoglycemia time from 12% to 3%. In the 80%-OBT scenario, time in target was augmented from 77% to 97% for the night/basal period, whereas the increase in post-prandial stage was from 66% to 99% time.

| | | Open-Loop(CSII) | | | Closed-Loop(pRBA) | | |
|---|---|---|---|---|---|---|---|
| OBT-ratio | Period | <70mg/dl | 70-180mg/dl | >180mg/dl | <70mg/dl | 70-180mg/dl | >180mg/dl |
| 120% | Night/Basal | 12% | 88% | 0% | 3% | 97% | 0% |
| | Post-prandial | 0% | 100% | 0% | 0% | 100% | 0% |
| 80% | Night/Basal | 0% | 77% | 23% | 0% | 97% | 3% |
| | Post-prandial | 0% | 66% | 34% | 0% | 99% | 1% |

CONCLUSIONS

The pRBA improved metabolic control by increasing time in target with respect to reference suboptimal basal insulin regimes.